

## Overview of Multilevel Modeling Texts and Suggested Readings

### Textbooks for Multilevel Modeling

*These texts cover multilevel modeling within the context of clustered (nested) observations primarily. They are ordered in terms of my opinion of their accessibility (most to least).*

Kreft, I., & de Leeuw, J. (1998). *Introducing multilevel modeling*. Thousand Oaks, CA: Sage.

Heck, R. H., & Thomas, S. L. (2008). *An introduction to multilevel modeling techniques* (2<sup>nd</sup> ed.). New York: Routledge

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications* (2<sup>nd</sup> ed.). New York: Routledge.

Snijders, T. A. B., & Bosker, R. (1999). *Multilevel analysis*. Thousand Oaks, CA: Sage.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2<sup>nd</sup> Ed.). Thousand Oaks, CA: Sage.

Stroup, W. W. (2012). *Generalized linear mixed models: Modern concepts, methods and applications*. Boca Raton, FL: CRC Press.

*These texts cover multilevel modeling within the context of longitudinal observations primarily. They are ordered in terms of my opinion of their accessibility (most to least).*

Hoffman, L. (2014). *Longitudinal analysis: Modeling within-person fluctuation and change*. New York: Routledge.

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York: Oxford University Press.

Fitzmaurice, G., Laird, N. M., & Ware, J. H. (2004). *Applied longitudinal analysis*. New York: Wiley.

Hedeker, D., & Gibbons, R. D. (2006). *Longitudinal data analysis*. New York: Wiley.

Verbeke, G., & Molenberghs, G. (2001). *Linear mixed models for longitudinal data*: New York: Springer-Verlag.

Diggle, P. J., Heagerty, P. J., Liang, K. Y., & Zeger, S. L. (2002). *Analysis of longitudinal data* (2<sup>nd</sup> ed.). New York: Oxford University Press.

*These texts cover longitudinal models within the context of structural equation modeling.*

Preacher, K. J., Wichman, A. L., MacCallum, R. C., & Briggs, N. E. (2008). *Latent growth curve modeling. Quantitative applications in the social sciences, #157*. Thousand Oaks, CA: Sage.

Bollen, K. A., & Curran, P. J. (2005). *Latent curve models: A structural equation perspective*. New York: Wiley.

Duncan, T. E., Duncan, S. C., Strycker, L. A., Li, F., & Alpert, A. (1999). *An introduction to latent variable growth curve modeling: Concepts, issues, and applications*. Mahwah, NJ: Erlbaum.

*The latter chapters in this ANOVA text introduce MLM from the ANOVA perspective.*

Maxwell, S. E., & Delaney, H. D. (2004). *Designing experiments and analyzing data*. Mahwah, NJ: Erlbaum.

## **Suggested Readings by Topic**

### *Introduction to MLM*

- Snijders & Bosker ch. 1-2
- Singer & Willett ch. 1-2
- Raudenbush & Bryk ch. 2
- Hoffman ch. 1

### *Review of General Linear Models*

- Hedeker & Gibbons ch. 1-3
- Fitzmaurice, Laird, & Ware ch. 5-6
- Hoffman ch. 2-3

### *Fixed vs. Random Effects of Time Polynomial Random Effects Models*

- Singer & Willett ch. 3-4
- Hedeker & Gibbons ch. 4
- Willett, J.B. (1989). Some results on reliability for the longitudinal measurement of change: Implications for the design of studies of individual growth. *Educational and Psychological Measurement*, 49, 587-602.
- Snijders & Bosker ch. 12
- Hox ch. 5
- Raudenbush & Bryk ch. 6
- Hoffman ch. 4-6

### *Alternative Metrics of Time*

- Hoffman, L. (in press). *Considering alternative metrics of time: Does anybody really know what "time" is?* Forthcoming in G. Hancock & J. Harring (Eds.), *Advances in Longitudinal Methods in the Social and Behavioral Sciences*.
- Sliwinski, M. J., Hoffman, L., & Hofer, S. M. (2010). Evaluating convergence of within-person change and between-person age differences in age-heterogeneous longitudinal studies. *Research in Human Development*, 7(1), 45-60.
- Sliwinski, M. J., Hofer, S. M., Hall, C. B., Buschke, H., & Lipton, R. B. (2003a). Modeling memory decline in older adults: The importance of preclinical dementia, attrition, and chronological age. *Psychology and Aging*, 18(4), 658-671.
- Singer & Willett ch. 5
- Hoffman ch. 10 (not drafted yet)

### ***Within-Person Change vs. Within-Person Fluctuation***

- Hoffman, L. (2007). Multilevel models for examining individual differences in within-person variation and covariation over time. *Multivariate Behavioral Research*, 42(4), 609-629. Available at: <http://digitalcommons.unl.edu/psychfacpub/417/>.
- Hoffman ch. 1

### ***Fun with Model Comparisons***

- Singer & Willett ch. 4
- Snijders & Bosker ch. 6-7
- Raudenbush & Bryk ch. 3
- Stoel, R. D., Garre, F. G., Dolan, C., & van den Wittenboer, G. (2006). On the likelihood ratio test in structural equation modeling when parameters are subject to boundary constraints. *Psychological Methods*, 11(4), 439-455.
- Verbeke & Molenberghs ch. 5-6
- Hoffman ch. 3 and 5

### ***Piecewise (Spline) Random Effects Models***

- Hernandez-Lloreda, M. V., Colmenares, F., & Martinez-Arias. (2004). Application of piecewise hierarchical linear growth modeling to the study of continuity in behavioral development of Baboons (*Papio hamadryas*). *Journal of Comparative Psychology*, 118(3), 316-324.
- Singer & Willett ch. 5-6
- Hoffman ch. 6

### ***Negative Exponential (and other Nonlinear Models)***

- Cudeck, R., & Harring, J. R. (2007). Analysis of nonlinear patterns of change with random coefficient models. *Annual Review of Psychology*, 58, 615-637.
- Grimm, K. J., & Ram, N. (2009). Nonlinear growth models in Mplus and SAS. *Structural Equation Modeling*, 16, 676-701.
- Hoffman ch. 6

### ***Interpreting Random Effects Variances and Covariances***

- Rovine, M. J., & Molenaar, P. C. M. (1998). The covariance between level and shape in the latent growth curve model with estimated basis vector coefficients. *Methods of Psychological Research Online*, 3(2), 95-107.
- Snijders & Bosker ch. 4
- Hoffman ch. 5

### ***Alternative Covariance Structure Models***

- Maxwell & Delaney ch. 13-15
- Singer & Willett ch. 7
- Snijders & Bosker ch. 12
- Fitzmaurice, Laird, & Ware ch. 7-8
- Hedeker & Gibbons ch. 6-7

- Wallace, D., & Green, S.B. (2002). Analysis of repeated measures designs with linear mixed models. In D.S. Moskowitz & S.L. Hershberger (Eds.), *Modeling intraindividual variability with repeated measures data* (pp. 103-134). Mahwah, NJ: Erlbaum.
- Hoffman ch. 4

### ***Time-Invariant Predictors***

#### ***Time-Varying Predictors and Centering Decisions***

- Hoffman, L., & Stawski, R. (2009). Persons as contexts: Evaluating between-person and within-person effects in longitudinal analysis. *Research in Human Development*, 6(2-3), 97-100. Available at: <http://digitalcommons.unl.edu/psychfacpub/415/>.
- Hofmann, D. A., & Gavin, M. B. (1998). Centering decisions in hierarchical linear models: Implications for research in organizations. *Journal of Management*, 24(5), 623-641.
- Kreft, I. G. G., de Leeuw, J., & Aiken, L. S. (1995). The effect of different forms of centering in hierarchical linear models. *Multivariate Behavioral Research*, 30(1), 1-21.
- Singer & Willett ch. 5
- Snijders & Bosker ch. 3-5
- Raudenbush & Bryk ch. 5
- Fitzmaurice, Laird, & Ware ch. 15
- Hedeker & Gibbons ch. 4
- Hoffman ch. 7-9

### ***Assumptions of MLM***

- Snijders & Bosker ch. 6, 9
- Raudenbush & Bryk ch. 9
- Hoffman ch. 9 (not drafted yet)

### ***Effect Size via Pseudo-R<sup>2</sup>***

- Snijders & Bosker ch. 7
- Hox ch. 4
- Raudenbush & Bryk ch. 5
- Hoffman ch. 7-8

### ***Two-Level Models for Clustered Observations***

#### ***Three-Level Models for Clustered Longitudinal Observations***

- Raudenbush & Bryk ch. 5, 8
- Snijders & Bosker ch. 4-5
- Hedeker & Gibbons ch. 13

### ***SAS and SPSS for Multilevel Models***

- Singer, J. D. (1998). Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models. *Journal of Educational and Behavioral Statistics*, 24(4), 323-355.
- Verbeke & Molenberghs ch. 8

- Peugh, James L., & Enders, Craig K. (2005). Using the SPSS MIXED procedure to fit cross-sectional and longitudinal multilevel models. *Educational and Psychological Measurement*, 65(5), 717-741.